

Retrograde catheterisation of left atrium

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SUMMARY Retrograde catheterisation of the left atrium using a no. 8 F pigtail catheter introduced percutaneously via a femoral artery was successfully accomplished in 48 out of 50 patients undergoing diagnostic cardiac catheterisation. There was one episode of ventricular fibrillation requiring cardioversion (without sequelae), and one episode of ventricular tachycardia which was self-terminating, but no other complications and no deaths. The average fluoroscopy time was four minutes.

There are two methods for recording the left atrial pressure: indirect and direct.

The indirect technique relies on measurement of the pulmonary artery wedge pressure. This method is simple and reliable and can be performed at the bedside using balloon-tipped catheters.

The direct method can be accomplished in one of three ways:

- (a) Via a probe through a patent foramen ovale which is present in approximately 10 per cent of adult patients undergoing diagnostic studies (Iskandrian *et al.*, 1977).
- (b) Transseptal puncture using specially designed needles and catheters (Ross *et al.*, 1959; Verel, 1967).
- (c) Retrograde transaortic transmitral approach using Shirey's catheter (Shirey and Sones, 1966), when using the brachial artery approach for left heart catheterisation. Unfortunately, both transseptal puncture and the retrograde Shirey technique require considerable skill and are not entirely free of morbidity and even mortality (Ross *et al.*, 1959; Shirey and Sones, 1966).

We describe a new and simple technique for left atrial catheterisation that can be accomplished safely and rapidly in laboratories using the percutaneous femoral artery approach for left heart catheterisation with a standard percutaneous catheter.

Subjects and methods

This study was carried out on 50 adult patients selected at random who were undergoing diagnostic cardiac catheterisation. Each patient underwent

left and right heart catheterisation in the fasting state via the right femoral artery and vein under local anaesthesia with lignocaine. Pressures were monitored and recorded on an Electronic for Medicine recorder.

TECHNIQUES FOR LEFT ATRIAL CATHETERISATION

We routinely use a no. 8 French pigtail catheter (Cordis) for left heart catheterisation with the percutaneous femoral artery approach. The catheter tapers to a no. 6 French near the tip and is provided with a pigtail loop 1.2 cm in diameter, and end hole, and 12 side holes. The catheter is advanced from the left cusp of the aortic valve into the left ventricle and the patient is positioned in a shallow right anterior oblique projection. A superiorly directed loop is formed in the left ventricular cavity and the loop enlarged by further advancement of the catheter with counter-clockwise rotation. Once the pigtail enters the left atrium, the catheter is withdrawn with gentle clockwise rotation. The pressure is continuously monitored during the procedure. A number of trials may be necessary in some patients in order to find the right size of the loop. Fig. 1 illustrates the steps during manipulation of the catheter for left atrial catheterisation.

Results

There were 37 men and 13 women, with a mean age of 46 years. Thirty-five patients had coronary artery disease, five had cardiomyopathy, four had mitral valve regurgitation, one had mild mitral stenosis (mitral valve area of 1.8 cm²), and five had no organic heart disease.

Fig. 2 shows cine frames of the position of the

Fig. 1 Diagram of retrograde left atrial catheterisation using a pigtail catheter. (a) The tip of the catheter is in the ventricular cavity; (b) a loop is formed in the left ventricle; (c) the loop is enlarged with counterclockwise rotation; (d) the loop is advanced into the left atrium and rotated clockwise.

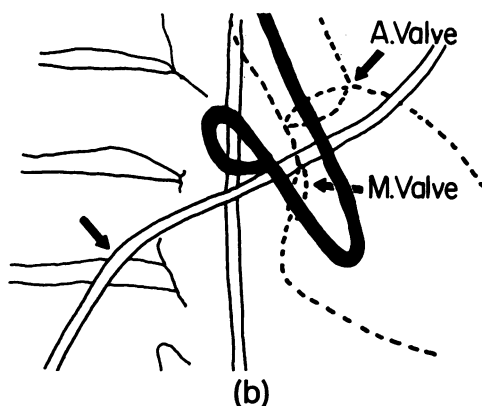
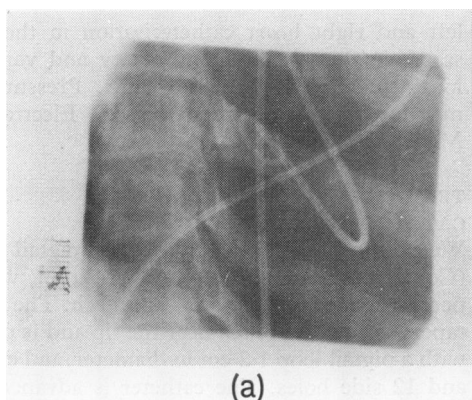
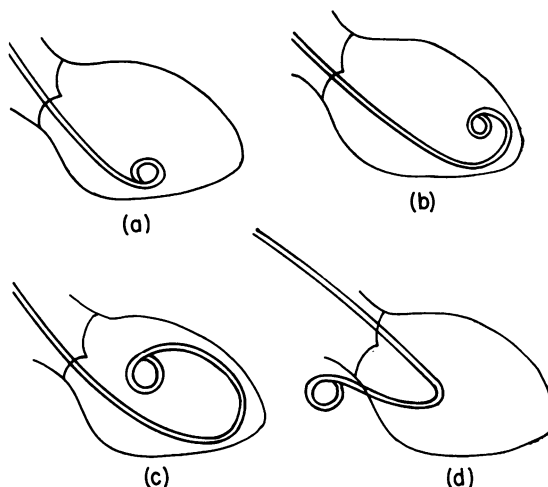
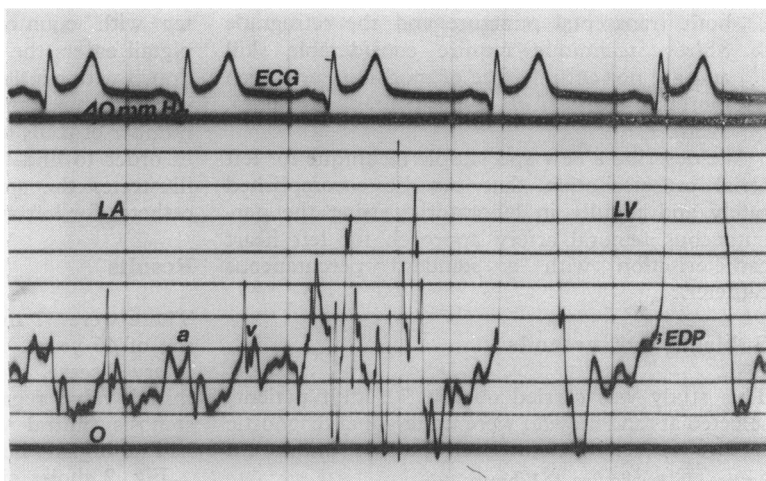


Fig. 2(a) Cine frame from a patient in the right anterior oblique projection showing the position of a pigtail catheter in the left atrium. **(b)** A diagram depicting the course of the catheter seen in Fig. 2a. The dotted lines represent the outline of the left ventricle and aorta. The arrow points to a right heart catheter. A. valve, aortic valve; M. valve, mitral valve.

Fig. 3 A pullback pressure tracing from the left atrium (LA) into the left ventricle (LV) on a scale of 0 to 40 mmHg. EDP indicates end-diastolic pressure; A and V are the left atrial pressure waves.



pigtail catheter in the left atrium in the right anterior oblique projection.

Fig. 3 is a pullback pressure tracing from the left atrium into the left ventricle in a patient with normal pressures.

Fig. 4 is a pullback pressure tracing from a patient with mitral regurgitation showing large 'V' waves in the left atrium.

Fig. 5 is a tracing of simultaneous left atrial and pulmonary artery wedge pressures from the same patient as in Fig. 4, showing that the left atrial pressure tracing is free of catheter artefacts and would almost be superimposed on the wedge pressure tracing.

COMPLICATIONS

Retrograde left atrial catheterisation was successfully accomplished in 48 out of the 50 patients including all with valvular heart disease. Ventricular extrasystoles and short runs of ventricular tachycardia (three to four complexes in a row) are common during the procedure, but disappear promptly upon withdrawal of the catheter. One patient developed ventricular fibrillation which required DC countershock; this did not necessitate premature termination of the catheterisation. One patient developed prolonged ventricular tachycardia that stopped when the catheter was withdrawn. There were no deaths and no other complications. In two patients, the procedure failed, because of extreme ventricular irritability in one patient, and for no obvious reason in the other. The average fluoroscopy time was four minutes (range 2 to 10 minutes).

The pressure tracings were all of excellent quality. Though we did not see it in our study, there is a possibility of dislodging emboli from clots in the left ventricle or left atrium.

Discussion

Retrograde left atrial catheterisation using a pigtail catheter is a safe, rapid, and reliable technique for

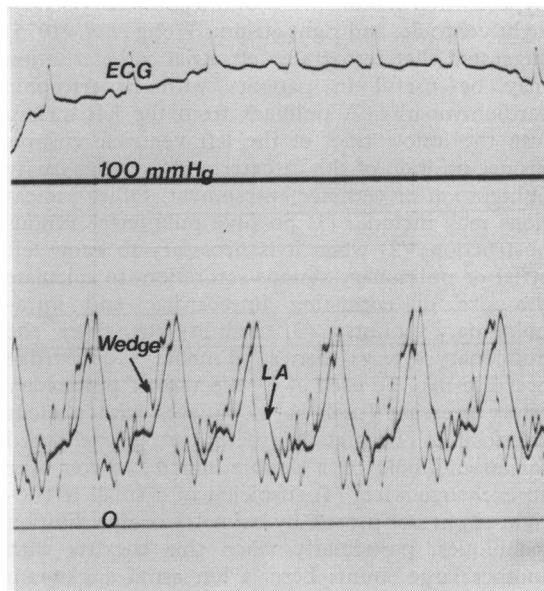


Fig. 5 A simultaneous pulmonary artery wedge and left atrial (LA) pressure tracing from the same patient as in Fig. 4 showing both pressures can be superimposed.

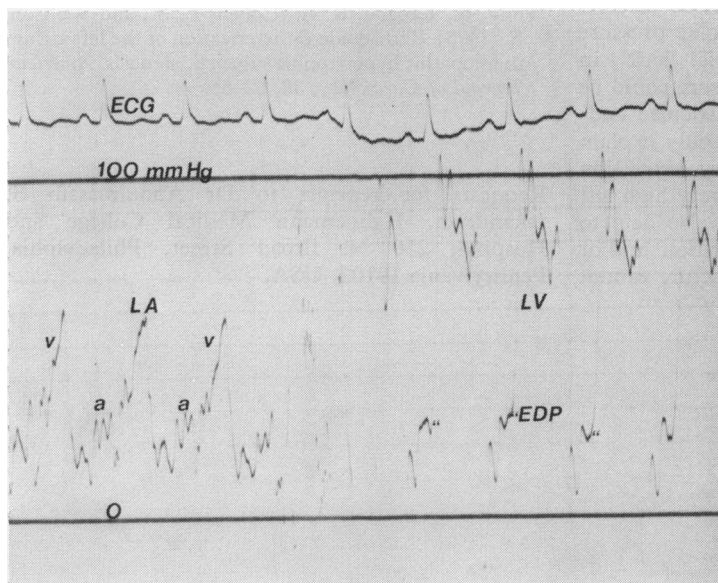


Fig. 4 A pullback pressure tracing from the left atrium into the left ventricle on a scale of 0 to 100 mmHg from a patient with mitral regurgitation showing large 'V' waves.

measuring the left atrial pressure. The indications for direct left atrial pressure recording are limited since pulmonary artery wedge pressure reliably reflects the left atrial pressure and can be performed safely and rapidly. However, at times wedge pressure recording may be very difficult if not impossible, especially in patients with mitral valve disease associated with significant pulmonary hypertension and dilatation of the pulmonary artery, right ventricle, and right atrium. Wong *et al.* (1975) suggested that retrograde left atrial catheterisation may be useful in patients with hypertrophic cardiomyopathy. A pullback from the left atrium into the inflow tract of the left ventricle ensures proper position of the catheter and excludes cavity obliteration or catheter entrapment. Other indications may include: (1) possible pulmonary venous obstruction; (2) when it is necessary to know left atrial or pulmonary venous saturation, to calculate the size of coexisting intracardiac and intra-pulmonary shunts; (3) inability to enter the pulmonary artery; then a pulmonary vein wedge pressure may be used as a reflection of pulmonary artery pressure (such as in patients with truncus arteriosus). The pigtail catheter can be exchanged for an end hole or a double lumen catheter over an exchange wire; (4) suspicion of a small left-to-right shunt not proven by oximetry or dye dilution techniques, particularly when this coexists with another large shunt: here, a left atrial angiogram may be useful; (5) when right heart catheterisation is not performed (that is patients having left heart catheterisation and angiography only), but where measurement of the left atrial pressure is likely to yield important information, for example patients with high left ventricular end-diastolic pressure primarily caused by a prominent atrial 'kick'; in such patients the mean left atrial pressure could be substantially lower than the left ventricular end-diastolic pressure, and thus may not only explain why signs and symptoms of pulmonary congestion are absent in spite of the presence of very high left ventricular end-diastolic pressure, but also help to define the appropriate level of hydration and/or medications; (6) when transseptal puncture cannot

be used because of severe right atrial enlargement, kyphoscoliosis, thrombophlebitis of the lower extremities, inferior vena caval ligation, or altered anatomical relations of the great vessels. This technique can also be used in laboratories performing catheterisations via the brachial artery. While the indications listed above are uncommon, we have encountered all in the past three years. The need to catheterise the left atrium is not always evident before the procedure; familiarity with this technique and its use has enabled us to obtain a complete diagnostic study. Arrhythmias have been of no more consequence to the patient than those encountered during other catheter manipulations (that is left ventriculography). The technique may be used whenever the direct left atrial pressure or left atrial oxygen saturations or left atrial angiography are essential for diagnostic evaluation.

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